

DRUG DISCRIMINATION

MED-PC[®] IV APPLICATION

SOF-700RA-24 Manual
DOC-186
Rev. 1.1

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CHAPTER 1

Introduction

The purpose of this manual is to give an explanation of the MED State Notation™ Procedures that comprise the SOF-700RA-24 Drug Discrimination Procedures. The files in this package can be found on the disk provided by MED Associates, Inc.

These procedures are intended to be run in MED Associates MED-PC® software. The latest version of MED-PC® gives researchers the ability to use pre-programmed procedures such as these to make hardware control and data collection easy. These pre-programmed procedures can also be modified to meet the evolving demands of a research protocol. Again, it is the intent of this manual to explain exactly what these procedures implement, and provide guidance into how to interpret what the program code achieves in order to let the user determine how to modify them to match their research protocol demands. The manual provides some examples of editing and modifying the procedure's programming code. The manual also defines the elements in the raw data file produced by these procedures.

In addition to this manual, refer to the **MED-PC® User's Manual** for the installation of the MED-Associates interface drivers, the MED-PC Software, and the Delphi® Compiler. Also refer to the User's Manual for instructions on developing a Hardware Configuration. Data file structure, file-saving format, and other related options are also determined by the Hardware Configuration. Running the Hardware Configuration software utility that accompanies MED-PC sets the Hardware Configuration. Its purpose is to assign the inputs and outputs on the interface cards in the interface cabinet for each task controlled by MED-PC. The particular type of interface card that is supplied in the interface cabinet may vary; please refer to the User's Manual provided for instructions on how to configure the type of card that is in the cabinet. A valid Hardware Configuration must exist in order for MED-PC to interface correctly with the MED Associates, Inc. hardware. This means that one should take the time to create a valid Hardware Configuration before attempting to run the procedures included in this package.

Should there be any problems, the staff at MED Associates, Inc. is available to answer any questions that may arise. Please e-mail us at support@med-associates.com with a detailed description of the problem or desired goals so that concise and detailed information may be provided.

The Drug Discrimination procedures are designed to be as easy to use as possible. MED Associates, Inc. understands that researchers do not have the time to devote to programming and hardware design, and for that reason, we have undertaken that burden for you. We sincerely hope that you are satisfied with the products and services we provide, and look forward to meeting your future experimental needs as your research program evolves.

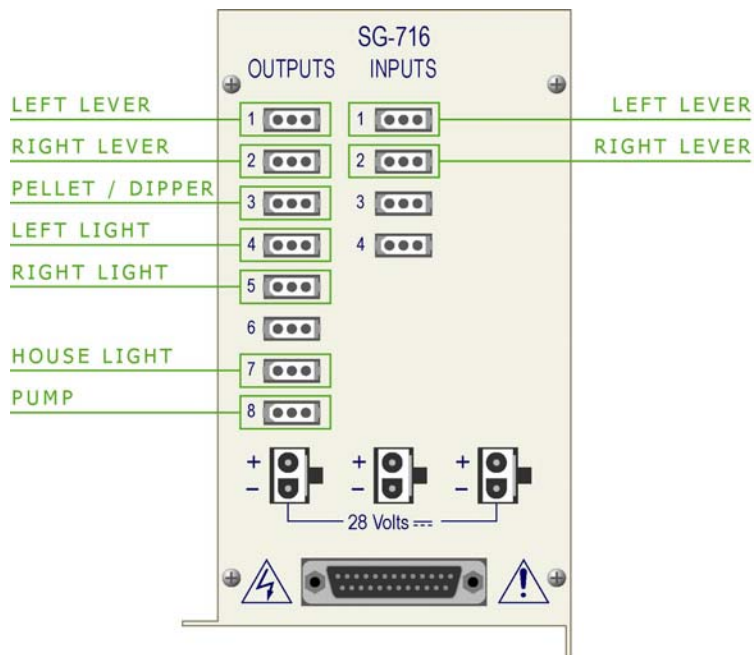
Overview of the Procedures

The Drug Discrimination programs were written for MED-PC IV. There are three different programs included on the Drug Discrimination CD: DD Food Shaping.mpc, DD Training.mpc and DD Testing.mpc.

Inputs and Outputs

The MED Interface Panel should be wired as follows when using the Drug Discrimination procedures. These connections can be different, but the procedures must be changed accordingly. If both a Pellet Feed and Dipper are being used concurrently, the output configuration must be changed in the procedure.

Figure 1.1 – Interface Panel Connections Labeled



DD Food Shaping.mpc

This program mimics a Fixed Ratio schedule. The program starts by turning on the house light and both the left and right stimulus lights. A trial consists of correctly responding on a lever to receive a reward, which is followed by a time-out. The program ends when the maximum number of rewards are earned or when the session time ends, whichever comes first. Total responses, total correct responses, total incorrect responses, percent correct responses, percent incorrect responses and total rewards are collected. By default, SoftCR Pro data will also be collected.

Variable Name	Default Value
Correct Lever (Left = 1; Right = 2)	1
Reward (Pellet = 1; Dipper = 2; Drug = 3)	1
Reward Time (seconds)	0.05
Time Out Following Reward (seconds)	0
Session Time (minutes)	60
Fixed Ratio Value	1
Maximum Rewards	50
SoftCR Data Array (Yes = 1; No = 0)	1

DD Training.mpc

This program begins with an Acclimation Time. Following the Acclimation time the program turns on the house light and both the left and right stimulus lights. Responses on the correct lever result in a reward and turn off all lights. This is followed by an inter-trial interval. Responses on the incorrect lever will reset the current fixed ratio. The program ends when maximum number of rewards are earned or when the session time ends. Totals for the whole program are collected; as well as the data for each trial. By default, SoftCR Pro data will also be collected.

Variable Name	Default Value
Correct Lever (Left = 1; Right = 2)	1
Acclimation Time (minutes)	5
ITI Time (seconds)	20
Fixed Ratio Value	20
Maximum Rewards	20
Reward (Pellet = 1; Dipper = 2; Drug = 3)	1
Reward Time (seconds)	0.05
SoftCR Data Array (Yes = 1; No = 0)	1

DD Testing.mpc

This program starts with an Acclimation Time. Following the Acclimation time the program turns on the house light and both the left and right stimulus lights. Responses on either lever will result in a reward and turn off all lights. This is followed by an inter-trial interval. The program ends when maximum number of rewards are earned or when the session time ends. Totals for the whole program are collected; as well as all data during each trial are collected. SoftCR is also recorded.

Variable Name	Default Value
Correct Lever (Left = 1; Right = 2)	1
Acclimation Time (minutes)	5
ITI Time (seconds)	20
Fixed Ratio Value	20
Maximum Rewards	20
Session Time (minutes)	15
Reward (Pellet = 1; Dipper = 2; Drug = 3)	1
Reward Time (seconds)	0.05
SoftCR Data Array (Yes = 1; No = 0)	1

CHAPTER 2

Getting Started

Software Installation

Please refer to the **MED-PC User's Manual** for a complete guide to installing the MED-PC software, building a valid Hardware configuration with the Hardware Configuration utility, and opening and compiling a MSN procedure in the Trans-IV utility.

To install the Drug Discrimination Procedures, insert the CD into the CD-ROM drive and click **Install the Drug Discrimination Software**. The procedures are copied into the indicated folder.

Backing Up the Software

Med Associates strongly encourages creating backup copies of the programs in case of disk failure. Having copies of the original programs may be useful in the future should modifications be made to the existing programs.

CHAPTER 3

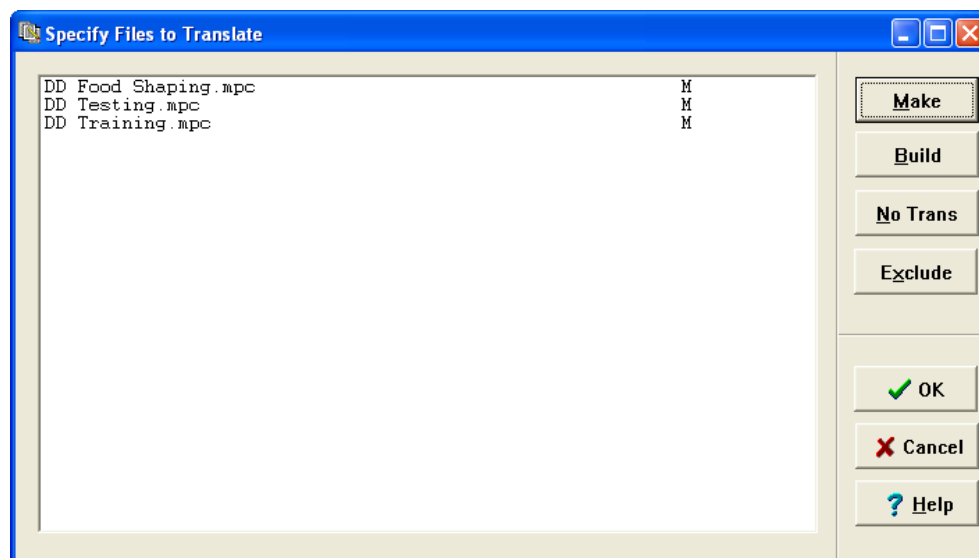
Beginning & Running an Experiment

Translating the MED-PC (.mpc) File

Programs written in MedState Notation must be translated using Trans IV before they can be executed in this application. Open Trans IV icon and select **Translation | Translate and Compile**.

Select the program(s) to use for the experiment and click **M**ake. Click **OK** to start the translator, and it will automatically parse the MedState Notation and then open to a DOS screen to compile the Pascal code. Depending on the speed of the computer, each of these steps may not be seen. If any problems are encountered during this process, refer to the on-screen help menu or the **MED-PC Version User's Manual**, or contact MED Associates, Inc. for assistance.

Figure 3.1 - Trans IV Control Panel for Translating and Compiling MedState Notation Code



Using the MED-PC Load Wizard

MED-PC is designed to help the researcher run an experiment by guiding selection choices through its Experiment Loading Wizard. This section will describe how to initiate the DD Food Shaping.mpc application, however the following steps that will also apply to all other .mpc procedures.

Open MED-PC and the MED-PC Experiment Loading Wizard's Welcome screen, shown in Figure 3.2 will appear.

Figure 3.2 - The MED-PC Loading Wizard Welcome Screen



To avoid this load wizard, deselect the checkbox labeled **Run this experiment automatically when starting MED-PC**. Close this screen by clicking the **Close** button. Closing this screen immediately reveals the MED-PC Run-Time Screen shown in Figure 3.9. If the choice to continue with the Loading Wizard is made, then click the **Next** button.

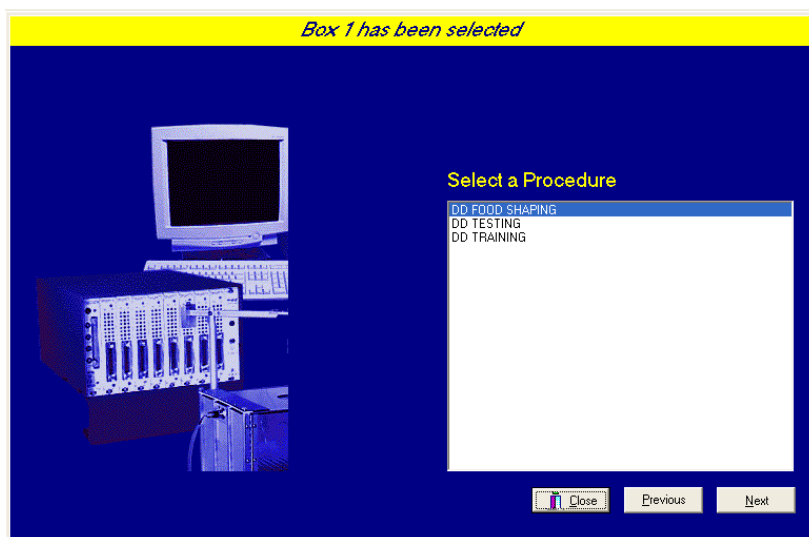
The Box Selection screen will appear next, as shown in Figure 3.3. From this screen the researcher chooses which boxes will be used in the experiment. Select the boxes that will run the experiment by clicking in the radio button next to the box number. The figure shows that the Hardware Configuration included only 1 box, which was selected. Click **Next** to continue.

Figure 3.3 - The Box Selection Screen



The Select a Procedure screen appears next, as seen in Figure 3.4. This is where the application to be run is selected. The screen displays a list of all the currently compiled procedures. Select the desired procedure and then click **Next**.

Figure 3.4 - The Select a Procedure Screen



The Enter Experiment Data Screen should display next, as shown in Figure 3.5. The purpose of this screen is to allow annotations to be added to the data file that is produced by MED-PC. These annotations will help identify the Subject, Experiment, and Experiment Group upon which data was collected. Comments can be added here as well, and the data file can be given a customized file name to help identify it from other data files. Enter the information desired, and click **Next**.

Figure 3.5 - Enter Experiment Data Screen

Box 1 and DD FOOD SHAPING have been selected

Subject:

Experiment:

Group:

Comments:

Optional Custom Filename:

Close Previous Next

The next screen to appear is the Review Choices screen, as seen in Figure 3.6. This is a method of confirming that the information received from the Box/Procedure Selected is correct. If it is not correct, select **Previous**, and edit the data. If it is correct, select **Next**.

Figure 3.6 - Review Choices Screen

Review Choices

Review the data below.

Box: 1

Procedure: DD FOOD SHAPING

Subject: Subject_1

Experiment: Experiment_1

Group: Group_1

Comment: Food_Shaping_Experiment

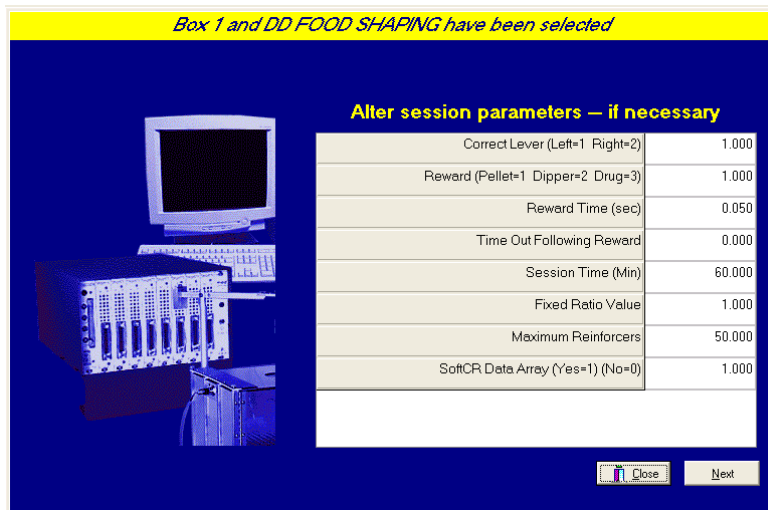
Filename: FoodShaping_Subject1_Group1

**Click "Next" to finish loading the box
or "Previous" to correct errors.**

Close Previous Next

The Alter Session Parameters Screen, shown in Figure 3.7, is the next screen to appear, and is an important screen for the researcher. The Alter Session Parameters screen allows the researcher to alter the parameters by which a procedure executes. The Send Start Command Screen appears next. The options available on the screen vary depending upon how many boxes are described in the Hardware Configuration.

Figure 3.7 - Alter Session Parameters Screen



In this example only one box is described in the Hardware Configuration, so Figure 3.8 will appear next. If more than one box is in the Hardware Configuration, then Figure 3.9 will appear.

Figure 3.8 - Send Start Command Screen for Single Box Configuration

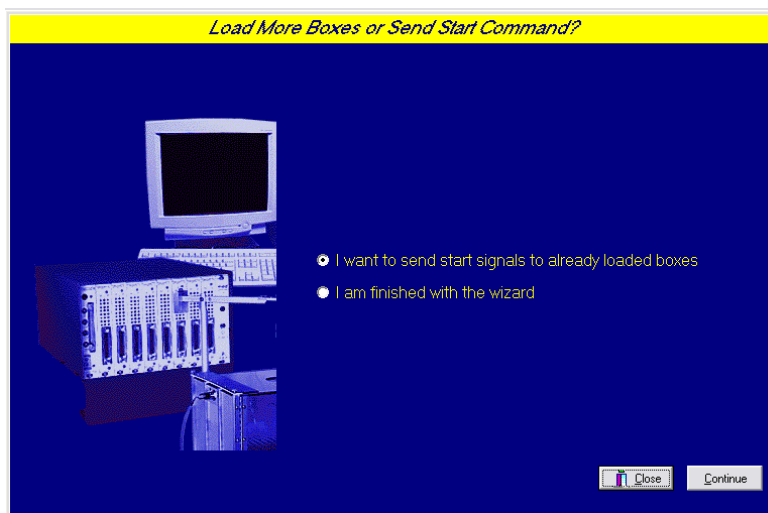
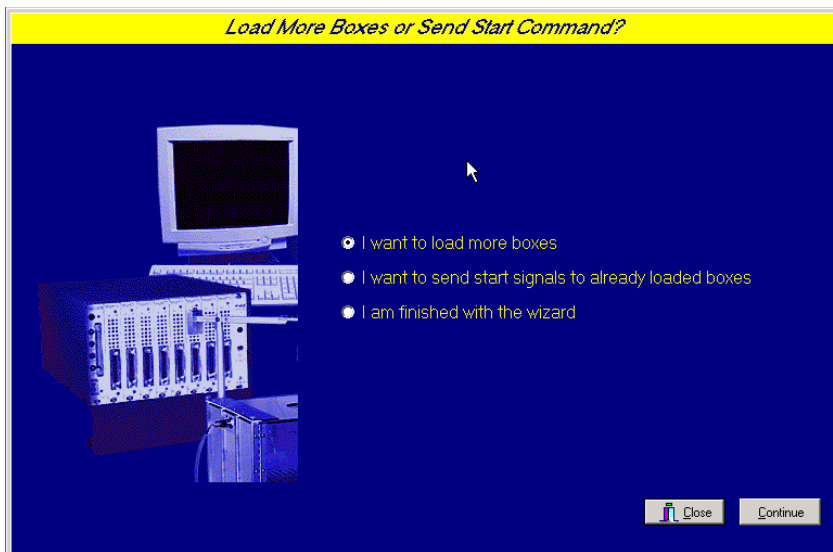
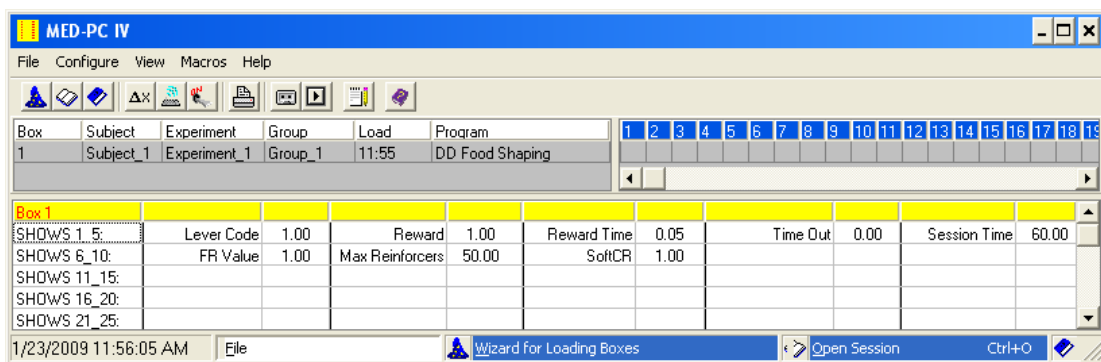


Figure 3.9 - Send Start Command Screen for Multiple Box Configuration



In both cases (Figure 3.8 and Figure 3.9), the screens are where the researcher decides to either load more boxes, send a start signal to boxes that are already loaded, or enter the MED-PC run-time environment without sending a start signal by selecting “I am finished with the wizard”. This option results in the screen shown in Figure 3.10.

Figure 3.10 - The MED-PC Run-Time Screen



Viewing/Changing Variable Values

Before a “start command” has been issued, any variable may be changed on the MED-PC run-time screen. Simply highlight the value to change, and then enter the new value. Once a session is in progress, change variables by selecting **Configure | Change Variables**, or click the 4th tool bar item ΔX . In the lower left hand corner of the Change Variables window, find the “Display Data from Box” display, and choose the chamber(s) to modify. By clicking additional boxes in the “Additional Boxes to Update” section, changes made to a single box are automatically loaded to all of the selected boxes.

Figure 3.11 - Changing Variables Screen

A Array	B Array	C Array	D: 0.000	E: 0.000
F: 0.000	G: 0.000	H: 0.000	I: 0.000	J: 0.000
K: 0.000	L: 0.000	M: 0.000	N: 0.000	O: 0.000
P: 0.000	Q: 0.000	R: 0.000	S: 0.000	T: 0.000
U: 0.000	V: 0.000	W: 0.000	X: 0.000	Y: 0.000
Z: 0.000				

Named Vars
Vars
Refresh
Issue
Close
Help

Display Data from Box
☒ 1

Additional Boxes to Update
☐ 1
Select All Deselect All

D from Box 1
0.000

The value of any simple variable may be viewed from this screen by clicking an array on the table and each element in that array can be viewed, as shown in Figure 3.12. To change a value, simply highlight and replace the value in the lower right hand box or use the up/down arrows to increment by 1. Click the **Issue** button for the change to take effect. Click **Named Variables** to produce the display in Figure 3.13. Change variables here as needed.

Figure 3.12 - Displaying Array A from Box 1

Displaying Array A from Box 1

A(0) 1.000	A(1) 1.000	A(2) 0.050	A(3) 0.000	A(4) 60.000
A(5) 1.000	A(6) 50.000	A(7) 0.000	A(8) 0.000	A(9) 1.000

Named Vars

Vars

Refresh

Issue

Close

Help

Display Data from Box

1

Additional Boxes to Update

1

Select All Deselect All

A(0) from Box 1

1.000

Figure 3.13 - Displaying Named Variables from Box 1

Displaying Named Variables from Box 1

Correct Lever (Left=1 Right=2)	1.000
Reward (Pellet=1 Dipper=2 Drug=3)	1.000
Reward Time (sec)	0.050
Time Out Following Reward	0.000
Session Time (Min)	60.000
Fixed Ratio Value	1.000
Maximum Reinforcers	50.000
SoftCR Data Array (Yes=1) (No=0)	1.000

Named Vars

Vars

Refresh

Issue

Close

Help

Display Data from Box

1

Additional Boxes to Update

1

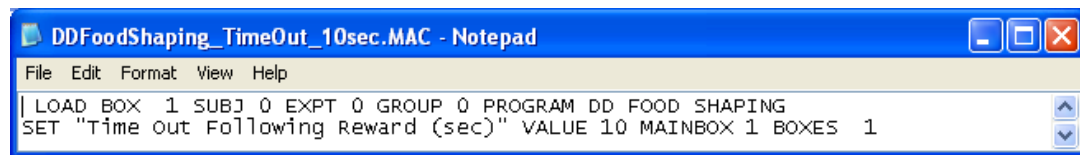
Select All Deselect All

Macros

The simplest way to initially create a macro is to record keyboard functions while performing the steps manually. Once the commands are in the macro, it is easy to create a number of macros with the macro editor. The following example illustrates the process of loading “Box 1” and changing the Time Out Following Reward to 10 seconds.

To begin, open MED-PC and going directly to the run time screen. Close the load wizard, if present. Before loading or opening the procedure, click **Macro** on the main menu and select **Turn On Macro Recorder** or click the 8th tool bar item with the cassette tape icon on top. A note on the bottom of the display indicates that the recorder is running. Open “DD Food Shaping.mpc” by clicking **Files | Open Session**. Change the variables using any of the methods described above. When all settings have been made, turn the recorder off again by using the main menu or tool bar. Save the macro with a distinctive name. The example in Figure 3.14 was named “DDFoodShaping_TimeOut_10sec.mac” since the Time Out Following Reward was changed to 10 seconds.

Figure 3.14 – DDFoodShaping_TimeOut_10sec.mac

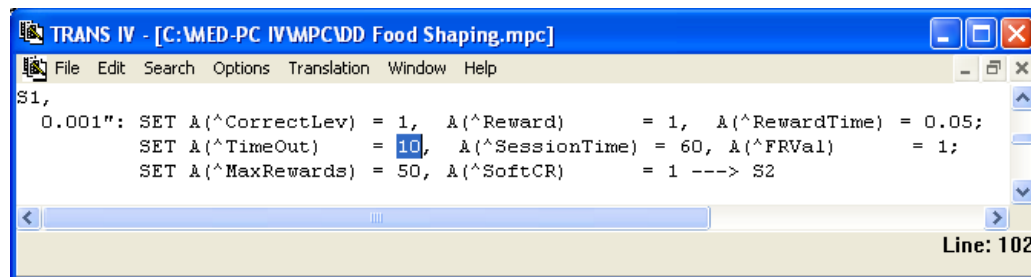


Once this macro is built, use the macro editor to make simple changes such as replacing reward or correct lever values. Review the Help file on screen or the **MED-PC User's Manual** for more information on macros and the features offered. A START command or message box followed by a START command could be added to the macro (it was left off here so changes could be verified before starting the procedure).

Modifying the MedState Notation™ Code

Permanent changes to the Drug Discrimination procedures can be made to the MedState Notation code. To make the same change to the Time Out Following Reward as shown above, do the following. Open Trans IV and select **File | Open** to place DD Food Shaping.mpc into the text editor. Scroll down to approximately line 102 (note the line counter in the lower right hand corner of the editor) to reveal the code shown in Figure 3.15.

Figure 3.15 – DD Food Shaping.mpc Line 102



Change $A(^{\text{TimeOut}}) = 0$ to $A(^{\text{TimeOut}}) = 10$ and save the changes with the same or a new file name such as DDFoodShaping_Time_Out_10sec.mpc. Remember, if creating a new .mpc file name and are using a macro to load boxes, the file name in the macro also must be changed. Translate and compile the new or changed file as described previously and run MED-PC IV. Use the “Change Variables” screen to view/confirm the new values.

CHAPTER 4

Understanding the MED State Notation™ Application

Introduction

See the **MED-PC User's Manual** for details regarding the processing of commands in MED-PC. The **MED-PC Programmer's Manual** and online tutorial provides necessary information on Med-State Notation, and these resources will be very helpful when making adjustments to an existing .mpc program, or creating a custom .mpc program.

A copy of the DD Food Shaping file follows for reference purposes, and State Sets (S.S. in the notation) are briefly described. State Sets 20 – 23 and 32 are the same in each program.

DD Food Shaping.mpc

\ Copyright (C) 2008 MED Associates, All rights reserved.

\ Drug Discrimination Food Shaping.mpc

\ Responses on the Correct Lever will give a Reward, followed by a Time Out.
 \ Program ends when Maximum Rewards are earned or when the Session Time ends.
 \ Totals are collected, and so is SoftCR.

\ Inputs

^LeftLever = 1

^RightLever = 2

\ Outputs

^LeftLeverOp = 1

^RightLeverOp = 2

^Pellet = 3 \ If both Pellet and Dipper are ordered

^Dipper = 3 \ It will be necessary to change one of these

^LeftLight = 4

^RightLight = 5

^HouseLight = 7

^Pump = 8

\ A() = Control Variables with Assigned Aliases as Defined

Var_Alias Correct Lever (Left=1 Right=2) = A(0) \ Default = Left Lever

Var_Alias Reward (Pellet=1 Dipper=2 Drug=3) = A(1) \ Default = Pellet

Var_Alias Reward Time (sec) = A(2) \ Default = 0.05 seconds

Var_Alias Time Out Following Reward (sec) = A(3) \ Default = 0 seconds

Var_Alias Session Time (min) = A(4) \ Default = 60 minutes

Var_Alias Fixed Ratio Value = A(5) \ Default = 1

Var_Alias Maximum Rewards = A(6) \ Default = 50

Var_Alias SoftCR Data Array (Yes=1 No=0) = A(9) \ Default = Yes

^CorrectLev = 0

^Reward = 1

^RewardTime = 2

^TimeOut = 3

^SessionTime = 4

^FRVal = 5

^MaxRewards = 6

^SoftCR = 9

^RewTimeTicks = 7

^TimeOutTicks = 8

```

\ List Data Variables Here
\ B() = Summary Data Array
\ B(0) = Total Responses
\ B(1) = Total Correct Response Count
\ B(2) = Total Incorrect Response Count
\ B(3) = % Correct
\ B(4) = % Incorrect

\ Constants for Summary Data Array B
^Total      = 0
^CorrectResp = 1
^IncorrectResp = 2
^Correct     = 3
^Incorrect   = 4
^TotalRewards = 5

\ C() = IRT Array and Event Pen Code for Soft Cum. Recorder

\ List Working Variables Here
\ I = Subscript for the IRT Array C
\ L = Ratio Count
\ S = Elapsed Time in Session

DIM A = 9
DIM B = 5
DIM C = 10000

\ Z-Pulses Used in this Program
^Z_Pellet    = 1 \ Signal Pellet Reward
^Z_Dipper    = 2 \ Signal Dipper Reward
^Z_Pump      = 3 \ Signal Pump Reward
^Z_Correct   = 4 \ Correct Response Signal
^Z_Incorrect = 5 \ Incorrect Response Signal
^Z_Reward    = 6 \ Reward Issued Signal
^Z_End       = 32 \ End of Session Signal

```

Description of State Set 1

State Set 1 is the main body of the program. The default values of the Change Variables are defined in this state set. Once a Start command is issued, the lights and levers turn on and the program moves to the first FR. It records correct and incorrect responses and moves to a Time Out once the FR is complete and a reward has been given. When the maximum number of rewards has been reached or the session time is complete (whichever happens first) the percent of correct and incorrect responses is calculated.

```

\*****
\      Drug Discrimination Food Shaping Schedule
\ S1 - Set Default Values
\      Correct Lever          (1-Left)
\      Reward                 (1-Pellet)
\      Reward Time            (0.05 seconds)
\      Time Out Following Reward (0 seconds)
\      Session Time           (60 minutes)
\      Fixed Ratio Value      (1)
\      Maximum Rewards        (50)
\      SoftCR Data Array      (1-Yes)
\*****
S.S.1,
S1,
  0.001": SET A(^CorrectLev) = 1, A(^Reward) = 1, A(^RewardTime) = 0.05;
          SET A(^TimeOut) = 0, A(^SessionTime) = 60, A(^FRVal) = 1;
          SET A(^MaxRewards) = 50, A(^SoftCR) = 1 ---> S2

```

```

S2,      \ First Statement: Wait for START signal, turn HouseLight ON,
          \ test for Correct Lever and turn associated stimulus ON.
          \
          \ Second Statement: Update screen display with default values
          \ for Control Variables. This will show any changes made via
          \ the "Configure | Change Variables" Window prior to START.
#START: CLEAR 1,60;
        SET A(^RewTimeTicks) = A(^RewardTime) * 1";
        SET A(^TimeOutTicks) = A(^TimeOut) * 1";
        ON ^LeftLight, ^RightLight, ^HouseLight;
        ON ^LeftLeverOp, ^RightLeverOp ---> S3
1": SHOW 1,Lever Code,A(^CorrectLev), 2,Reward,A(^Reward), 3,Reward
Time,A(^RewardTime);
        SHOW 4,Time Out,A(^TimeOut), 5,Session Time,A(^SessionTime), 6,FR Value,A(^FRVal);
        SHOW 7,Max Rewards,A(^MaxRewards), 8,SoftCR,A(^SoftCR) ---> SX

S3,      \ Test for Correct Lever
        #RA(^CorrectLev): ADD L, B(^Total), B(^CorrectResp); Z^Z_Correct;
        IF L >= A(^FRVal) [@FR_Value_Met, @False]
        @FR_Met: ADD B(^TotalRewards); SET L = 0; ZA(^Reward); Z^Z_Reward; --->
S4
        @False: ---> SX
        #R^LeftLever: ADD B(^Total), B(^IncorrectResp); Z^Z_Incorrect ---> SX
        #R^RightLever: ADD B(^Total), B(^IncorrectResp); Z^Z_Incorrect ---> SX
        #Z^Z_End: ---> S10

S4,      \ Time Out Interval Following Reward
        A(^TimeOutTicks)#T: IF B(^TotalRewards) >= A(^MaxRewards) [@End, @Cont]
        @End: Z^Z_End ---> S10
        @Cont: ---> S3
        #Z^Z_End: ---> S10

S10,     \ End of Session - Turn Lights Off
          \ Calculate % Correct and % Incorrect.
0.01": OFF ^HouseLight, ^LeftLight, ^RightLight;
        IF B(^Total) = 0 [@NoCalc, @Calculate]
        @NoCalc: SHOW 6,% Correct,B(^Correct), 7,% Incorrect,B(^Incorrect) ---> S11
        @Calculate: SET B(^Correct) = (B(^CorrectResp) / B(^Total)) * 100;
        SET B(^Incorrect) = (B(^IncorrectResp) / B(^Total)) * 100;
        SHOW 6,% Correct,B(^Correct), 7,% Incorrect,B(^Incorrect) ---> S11

S11,     \ Holding State at End of Session
1': ---> SX

```

Description of State Set 2

State Set 2 waits for a reward to be given and then times how long that reward is given for.

```

\*****
\          REWARD CONTROL TIMER
\*****
S.S.2,
S1,
#Z^Z_Pellet: ON ^Pellet ---> S2
#Z^Z_Dipper: ON ^Dipper ---> S2
#Z^Z_Pump:   ON ^Pump ---> S2

S2,      \ Time Reward Device for A(^RewardTime) seconds
          \ Default value set in S.S.1, S1 & S2
        A(^RewTimeTicks)#T: OFF ^Pellet, ^Dipper, ^Pump ---> S1

```

```

\*****
\      UPDATE DISPLAY
\*****
S.S.3,
S1,
  #START:  SHOW   2,Tot   Cor   Rsp,B(^CorrectResp),   3,Tot   Incor   Rsp,B(^IncorrectResp),
4,Reward,B(^TotalRewards) ---> S2

S2,
  1":  SHOW   2,Tot   Cor   Rsp,B(^CorrectResp),   3,Tot   Incor   Rsp,B(^IncorrectResp),
4,Reward,B(^TotalRewards) ---> S2

```

Description of State Set 20

State Set 20 counts the time used for recording SoftCR data, with a resolution of 10 milliseconds.

```

\*****
\      INCREMENT TIME T FOR IRT AND EVENT ARRAY
\*****
S.S.20,
S1,
  #START: IF A(^SoftCR) > 0 [] ---> S2

S2,
  0.01": ADD T ---> SX
  #Z^Z_End: ---> S1

```

Description of State Set 21

State Set 21 records a Step in SoftCR for every correct response that is made.

```

\*****
\      ADD A STEP ELEMENT TO ARRAY C FOR EACH CORRECT RESPONSE
\*****
S.S.21,
S1,
  #START: IF A(^SoftCR) > 0 [] ---> S2

S2,
  #Z^Z_Correct: SET C(I) = T + 0.10, T = 0; ADD I;
                IF I = 10000 [@True, @False]
                  @True: ---> S2
                  @False: SET C(I) = -987.987 ---> SX
  #Z^Z_End: ---> S1

```

Description of State Set 22

State Set 22 records a Pip in SoftCR for every reward that is issued.

```

\*****
\      ADD A PIP ELEMENT TO ARRAY C FOR EACH REWARD
\*****
S.S.22,
S1,
  #START: IF A(^SoftCR) > 0 [] ---> S2

S2,
  #Z^Z_Reward: SET C(I) = T + 0.20, T = 0; ADD I;
                IF I = 10000 [@True, @False]
                  @True: ---> S1
                  @False: SET C(I) = -987.987 ---> SX
  #Z^Z_End: ---> S1

```

Description of State Set 23

State Set 23 records a spike in SoftCR in the event pen line 0 for every incorrect response.

```
\*****
\ ADD AN EVENT ELEMENT TO ARRAY C FOR EACH INCORRECT RESPONSE
\*****
S.S.23,
S1,
  #START: IF A(^SoftCR) > 0 [@True, @False]
          @True: SET C(I) = 0.50, I = I + 1, C(I) = -987.987 ---> S2
          @False: ---> S1
S2,
  #Z^Z_Incorrect: SET C(I) = T + 0.60, C(I+1) = 0.50, T = 0, I = I + 2;
                  IF I = 10000 [@True, @False]
                  @True: ---> S1
                  @False: SET C(I) = -987.987 ---> SX
  #Z^Z_End: ---> S1
```

Description of State Set 32

State Set 32 counts the total session time and ends the program when the maximum time allowed has been reached.

```
\*****
\          SESSION CLOCK
\*****
S.S.32,
S1,
  #START: SHOW 1,Session,S/60 ---> S2

S2,
  1": ADD S; SHOW 1,Session,S/60;
      IF S/60 >= A(^SessionTime) [@EndSession, @ContinueTiming]
          @End: Z^Z_End ---> S3
          @Cont: ---> SX
  #Z^Z_End: ---> S3

S3,      \ Wait for Screen Update and end with
          \ STOPABORTFLUSH for Automatic Data Saving
  A(^RewTimeTicks)#T: ---> STOPABORTFLUSH
```

CHAPTER 5

Understanding the Data Files

Data can be saved manually by selecting **FILE | SAVE DATA MANUALLY** or **FILE | SAVE DATA (FLUSH)**. The file name that is used to save the data in depends on the option that was chosen in the Hardware Configuration Utility and may also be dependent on the Subject, Experiment, and Group name provided in the MED-PC load wizard. Within each data file, the headings are created for each Subject, Experiment, Group, Box, etc., (see below). Data files may be opened with note pad, word pad, or any word processor or spreadsheet; however, be sure they are always saved “unformatted” in case a data extraction utility such as MED-PC to Excel might ever be used. Data file formats are explained in detail in the **MED-PC User’s Manual**.

DD Food Shaping.mpc Sample Data File

Select **Annotated** on the file options page during hardware installation to produce a raw data file similar to the following. Data files may be opened with note pad, word pad, or any word processor; however, be sure they are always saved unformatted in the occasion a data extraction utility such as MPC2XL is used. The header information should be self-explanatory. Data-file formats are explained in detail in the **MED-PC User’s Manual**.

File: C:\MED-PC IV\DATA\!2007-10-02

```

Start Date: 10/02/07
End Date: 10/02/07
Subject: 0
Experiment: 0
Group: 0
Box: 1
Start Time: 14:09:55
End Time: 14:12:19
MSN: DD Food Shaping
D:      0.000      Not Used
E:      0.000      Not Used
F:      0.000      Not Used
G:      0.000      Not Used
H:      0.000      Not Used
I:    129.000      Subscript for the IRT Array C
J:      0.000      Not Used
K:      0.000      Not Used
L:      0.000      Ratio Count
M:      0.000      Not Used
N:      0.000      Not Used
O:      0.000      Not Used
P:      0.000      Not Used
Q:      0.000      Not Used
R:      0.000      Not Used
S:    139.000      Elapsed Time in Session
T:      0.000      Not Used
U:      0.000      Not Used
V:      0.000      Not Used
W:      0.000      Not Used
X:      0.000      Not Used
Y:      0.000      Not Used
Z:      0.000      Not Used

```

Array A

Array A contains the control variable values. The values are preset to default values in State Set 1, State 1. They are displayed as named variables and can be changed by any of the methods described previously. Once a session is started these values should not be changed to ensure the integrity of the experiment.

	A(0)	A(1)	A(2)	A(3)	A(4)	A(5)	A(6)	A(7)	A(8)	A(9)
Row Marker	Correct Lever	Reward	Reward Time	Time Out Following Reward	Session Time	Fixed Ratio Value	Maximum Rewards	Reward Time in MED Ticks	Time Out in MED Ticks	SoftCR
0:	1.000	1.000	0.050	0.000	60.000	1.000	50.000	5.000	0.000	1.000

Array B

The B Array contains trial data.

	B(0)	B(1)	B(2)	B(3)	B(4)	B(5)
Row Marker	Total Responses	Total Correct Responses	Total Incorrect Responses	% Correct Responses	% Incorrect Responses	Total Rewards
0:	64.000	50.000	14.000	78.125	21.875	50.000

Array C

Array C contains summary information for SoftCR Pro. The value of every variable conforms to the Data Element Format described. Please refer to the **SoftCR Pro User's Manual** for more information.

If the fixed ratio is left at 1 (default value), then reinforcement takes place every time a response on the correct lever occurs. Response time values are represented in SoftCR ticks. To calculate when a response has occurred in real time, multiply the number by 0.01 sec since SoftCR Pro's resolution is 10ms (0.01 sec). For example, value in C (1) is 231 ticks. 231 multiplied by 0.01 sec yields 2.31 seconds. This is when the first response has occurred in real time after the program has started.

Only a portion of Array C is shown below.

	C(0)	C(1)	C(2)	C(3)	C(4)
Row Marker	SoftCR is Activated	Correct Response	Reward	Correct Response	Reward
0:	0.500	231.100	0.200	72.100	0.200
	C(5)	C(6)	C(7)	C(8)	C(9)
	Correct Response	Reward	Incorrect Response	Set Event Pen to Level 0	Incorrect Response
5:	42.100	0.200	40.600	0.500	27.600
	C(10)	C(11)	C(12)	C(13)	C(14)
	Set Event Pen to Level 0	Incorrect Response	Set Event Pen to Level 0	Correct Response	Reward
10:	0.500	33.600	0.500	31.100	0.200

DD Training.mpc and DD Testing.mpc Sample Data File

The data files generated by the DD Training.mpc and DD Testing.mpc procedures will appear the same and therefore just one example is shown below.

File: C:\MED-PC IV\DATA\!2007-10-02

Start Date: 10/02/07
 End Date: 10/02/07
 Subject: 0
 Experiment: 0
 Group: 0
 Box: 1
 Start Time: 14:15:01
 End Time: 14:30:12
 MSN: DD Training

E:	0.000	Not Used
F:	0.000	Not Used
G:	0.000	Not Used
H:	0.000	Not Used
I:	269.000	Subscript for the IRT Array C
J:	72.000	Subscript for the Trial by Trial Array D
K:	0.000	Not Used
L:	13.000	Ratio Count
M:	0.000	Not Used
N:	0.000	Not Used
O:	0.000	Not Used
P:	0.000	Not Used
Q:	0.000	Not Used
R:	0.000	Not Used
S:	9.100	Trial Time Counter
T:	66.000	Elapsed Time in 0.01 sec Increments for SoftCR Data
U:	0.000	Not Used
V:	0.000	Not Used
W:	0.000	Not Used
X:	0.000	Not Used
Y:	0.000	Not Used
Z:	0.000	Not Used

Array A

Array A contains the control variable values. The values are preset to default values in State Set 1, State 1. They are displayed as named variables and can be changed by any of the methods described previously. Once a session is started these values should not be changed to ensure the integrity of the experiment.

	A(0)	A(1)	A(2)	A(3)	A(4)	A(5)	A(6)	A(7)	A(8)	A(9)	A(10)	A(11)
Row Marker	Correct Lever	Acclim. Time	ITI Time	FR Value	Max Rewards	Session Time	Reward	Reward Time	SoftCR	Acclim. Time in MED Ticks	ITI Time in MED Ticks	Reward Time in MED Ticks
0:	1.000	5.000	20.000	20.000	20.000	15.000	1.000	0.050	1.000	30000.000	2000.000	5.000

Array B

The B Array contains trial data.

	B(0)	B(1)	B(2)	B(3)	B(4)	B(5)	B(6)	B(7)
Row Marker	Total Responses	Total Correct Responses	Total Incorrect Responses	Total Rewards	Total Session Time	Total Trials	% Correct Responses	Total Response Rate
0:	243.000	226.000	17.000	8.000	900.000	9.000	93.004	0.270

Array C

Array C contains summary information for SoftCR Pro. The value of every variable conforms to the Data Element Format described. Please refer to the **SoftCR Pro User's Manual** for more information.

If the fixed ratio is left at 20 (default value), then reinforcement takes place after 20 responses on the correct lever occur. Response time values are represented in SoftCR ticks. To calculate when a response has occurred in real time, multiply the number by 0.01 sec since SoftCR Pro's resolution is 10ms (0.01 sec). For example, value in C (1) is 387 ticks. 387 multiplied by 0.01 sec yields 3.87 seconds. This is when the first response has occurred in real time after the program has started.

Only a portion of Array C is shown below.

	C(0)	C(1)	C(2)	C(3)	C(4)	C(5)	C(6)	C(7)	C(8)
Row Marker	SoftCR is Activated	Incorrect Response	Set Event Pen to Level 0	Incorrect Response	Set Event Pen to Level 0	Correct Response	Correct Response	Correct Response	Correct Response
0:	0.500	387.600	0.500	128.600	0.500	177.100	97.100	205.100	145.100
	C(9)	C(10)	C(11)	C(12)	C(13)	C(14)	C(15)	C(16)	C(17)
	Correct Response	Correct Response	Correct Response	Correct Response	Incorrect Response	Set Event Pen to Level 0	Incorrect Response	Set Event Pen to Level 0	Incorrect Response
9:	125.100	78.100	113.100	68.100	128.600	0.500	51.600	0.500	81.600
	C(18)	C(19)	C(20)	C(21)	C(22)	C(23)	C(24)	C(25)	C(26)
	Correct Response	Correct Response	Correct Response	Correct Response	Correct Response	Correct Response	Correct Response	Correct Response	Correct Response
18:	0.500	47.100	34.100	37.100	21.100	19.100	18.100	16.100	17.100

Array D

Array D contains trial-by-trial data.

	D(J)	D(J+1)	D(J+2)	D(J+3)	D(J+4)	D(J+5)	D(J+6)	D(J+7)	D(J+8)
Row Marker	Trial Number	Total Responses	Correct Responses	Incorrect Responses	Reset FR*	Trial Time	% Correct	Response Rate	Fixed Ratio
0:	1.000	33.000	28.000	5.000	1.000	46.930	84.848	0.703	20.000
9:	2.000	20.000	20.000	0.000	0.000	35.200	100.000	0.568	20.000
18:	3.000	28.000	25.000	3.000	1.000	25.460	89.286	1.100	20.000
27:	4.000	20.000	20.000	0.000	0.000	24.190	100.000	0.827	20.000
36:	5.000	41.000	35.000	6.000	2.000	31.180	85.366	1.315	20.000
45:	6.000	29.000	28.000	1.000	1.000	64.090	96.552	0.452	20.000
54:	7.000	20.000	20.000	0.000	0.000	32.660	100.000	0.612	20.000
63:	8.000	39.000	37.000	2.000	2.000	331.190	94.872	0.118	20.000
82:	9.000	13.000	13.000	0.000	0.000	9.100	100.000	1.429	20.000

CHAPTER 6

Using SoftCR™ Pro

The Fixed Ratio procedure stores IRT data in array C that may be used by the SoftCR™ Pro Cumulative Recorder program to generate a graphical record on screen or to print a Cumulative Record after the data has been collected. Each element in this "Cumulative Record" data array consists of two components. The integer value or value to the left of the decimal point is the time component. The decimal value or value to the right of the decimal point is a SoftCR Pro code component. Refer to the **SoftCR Pro User's Manual** for further information.

Time Components

Time components may be Relative or Absolute. In a Relative file, the time component of a given data element is equal to the elapsed time since the previous element. In an Absolute file, it is equal to the elapsed time since the beginning of the Record. The elements used in Fixed Ratio are all Relative with a resolution of 0.01 seconds (10 milliseconds).

Control Code Components

The control code component indicates whether the element is a Response Step, Reinforcement Pip, Pen Reset, Event Pen Up, or Event Pen Down element. Up to 10 Event Pens (0 - 9) and 10 Trace Pens (0 - 9) may be specified in MED-PC. In addition, Resets may be made with the Pen "Up" (no vertical tracing) or "Down." Additional coded information may be possible in the future.

Data Element Format

Each data element must conform to the following format:

nnnnn.xyz

Where:

nnnnn = Time Component

xyz = Control Code Component

x = Datum Type

y = Datum Index

z = Don't Care Digit

NOTE: If there are more than three numbers past the decimal point, then the array will be considered invalid and will be ignored by SoftCR Pro.

Allowed datum types and indices are:

nnnnn.1yz	=	Response or Step y = Index (0 - 9) for Multi-Trace Files "NULL" for Single Trace Files
nnnnn.2yz	=	Reward or Pip y = Index (0 - 9) for Multi-Trace Files "NULL" for Single Trace Files
nnnnn.3yz	=	Unused
nnnnn.4yz	=	Unused
nnnnn.5yz	=	Set Event Pen To Level 0 ("Down" or at baseline), where y = Event Pen Number (0 - 9)
nnnnn.6yz	=	Incorrect Response or Set Event Pen To Level 1 ("Up"), where y = Event Pen Number (0 - 9)
nnnnn.7yz	=	Unused
nnnnn.8yz	=	Unused
nnnnn.9yz	=	Unused

Data in the array being plotted that does not conform to the above rules will be ignored.

Example of SoftCR Pro

Figure 6.1 is an example of what Fixed Ratio will look like in SoftCR Pro after an experiment is run. The red line records a Step for every correct response that is made. Since this is a Fixed Ratio of 1 schedule the subject was reinforced after one response on the Left Lever. A reward is recorded as a Pip, or a hash mark on the red line.

The colored traces at the bottom of the screen are called Event Pens and can be used in a variety of ways for a number of purposes. The Event Pens can go up and down, creating quick spikes like the ones seen here, or long plateaus that represent certain periods of time during an experiment. Here, the Event Pen 0 records a Spike for every incorrect response that is made.

Figure 6.1 - Example of a DD Food Shaping Schedule Shown in SoftCR Pro

